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| APPLICATION NO.  | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO.     | CONFIRMATION NO. |
|--|-------------|----------------------|-------------------------|------------------|
| 10/621,967   | 07/17/2003  | Wei-Kan Chu          | 123029-1015 (UHID 2228) | 2046             |
| 37058  | 7590        | 01/07/2004           | EXAMINER                |                  |
| TIM HEADLEY<br>GARDERE WYNNE SEWELL LLP<br>1000 LOUISIANA, SUITE 3400<br>HOUSTON, TX 77002 |             |                      | THOMAS, TONIAE M        |                  |
|  |             |                      | ART UNIT                | PAPER NUMBER     |
|  |             |                      | 2822                    |                  |

DATE MAILED: 01/07/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

|                              |                        |                     |  |
|------------------------------|------------------------|---------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b> | <b>Applicant(s)</b> |  |
|                              | 10/621,967             | CHU ET AL.          |  |
|                              | <b>Examiner</b>        | <b>Art Unit</b>     |  |
|                              | Toniae M. Thomas       | 2822                |  |

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 17 July 2003.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1,2,5,6 and 8-14 is/are rejected.
- 7) ☒ Claim(s) 3,4,7 and 15 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 17 July 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All   b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☒ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.  
a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                       | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                              | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>07172003</u> | 6) <input type="checkbox"/> Other: _____                                    |

### DETAILED ACTION

1. This action is a first Office action on the merits of application Serial No. 10/621,967. Currently, claims 1-15 are pending.

#### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. *Claims 1, 2, 8, 10, and 12 are rejected under 35 U.S.C. 102(e) as being anticipated by Lee et al. (US 6,518,136 B2).*

The Lee et al. patent (Lee) discloses a method of forming a microelectronic structure on a semiconductor material having a silicon surface layer on a substrate (figs. 1-6 and accompanying text). The method comprises the following steps, as recited in claim 1: implanting first dopant ions onto the surface layer (figs. 3, 5, and col. 3, lines 15-20 and 57-61), wherein the step of implanting first dopant ions comprises a high energy implant for forming source/drain regions 24 (fig. 3 and col. 3, lines 15-20), and comprises a low energy implant for forming source/drain extensions 26 (fig. 5 and col. 3, lines 57-61); subjecting the semiconductor material to a first annealing process for

activating the source/drain extensions 26 (col. 3, lines 61-65); and subjecting the semiconductor material to a second annealing process for activating halo regions 28 (col. 4, lines 14-18).<sup>1</sup>

Second dopant ions of a second conductivity type opposite in polarity to the first conductivity type are implanted onto the surface layer to form the halo regions 28 (fig. 5). The second dopant ions are implanted at an acceleration energy from 50eV to 5000eV (5keV) and with a dosage from  $1 \times 10^{13}/\text{cm}^2$  to  $1 \times 10^{16}/\text{cm}^2$ , as recited in claim 2 (3, line 66 - col. 4, line 4).

The second annealing process comprises heating the semiconductor material with such temperature, amount of time, and heating and cooling rates so that minimal dopant diffusion occurs, as recited in claim 8 (col. 4, lines 15-24).

The second dopant ions are selected from the group consisting of boron, arsenic, phosphorus, and antimony, as recited in claim 10 (col. 3, line 66 - col. 4, line 4).

The second annealing process occurs any time after the first annealing process, as recited in claim 12 (col. 3, line 57 - col. 4, line 24).

3. *Claims 13 and 14 are rejected under 35 U.S.C. 102(b) as being anticipated by Eaglesham et al. (US 5,731,626).*

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<sup>1</sup> Since the annealing process used to activate the source/drain extensions 26 is performed first with respect to the annealing process used to activate the halo regions 28, the annealing process for activating the source/drain extensions is designated as a first annealing process and the annealing process for activating the halo regions is designated as a second annealing process.

The Eaglesham et al. patent (Eaglesham) discloses a method of forming a microelectronic structure on a semiconductor material by molecular beam epitaxy growth (col. 5, line 10 – col. 6, line 9). The method comprises the following steps, as recited in claim 13: exposing, in a vacuum chamber, a single crystal semiconductor body to a flux of one or more atomic or molecular species, with the body maintained at a temperature greater than about 100°C and less than about 800°C., thereby depositing a single crystal epitaxial layer with doped atoms that are electrically active (col. 5, lines 10-15); and subjecting the semiconductor material to a post-growth annealing process (col. 5, lines 46-51).

The annealing process occurs in situ in a vacuum, nitrogen gas, and inert gas, as recited in claim 14 (col. 5, lines 46-51).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. *Claims 5, 6, and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee et al. (US '136) in view of Lee (US 6,037,640).*

Lee (US '136) does not teach that the first annealing process comprises: heating the semiconductor material from about 800°C to about 1200°C with a ramp-up rate of

about 500°C/s. to about 1000°C/s, and after reaching a first desired temperature, holding the temperature for a time period from about 1 ms to about 1000 s, as recited in claim 5; and cooling the semiconductor material at a ramp-down rate from about 50°C/s to about 500 °C/s, as recited in claim 6.

The Lee patent [Lee (US '640)] discloses a method of forming a microelectronic structure on a semiconductor material having a silicon surface layer on a substrate (figs. 2a-2e and col. 5, line 8 – col. 8, line 16). The method comprises the steps of: implanting first dopant ions onto the surface layer to form source/drain extensions 24 (fig. 2e and col. 6, lines 36-58); heating the semiconductor material from about 800°C to about 1200°C with a ramp-up rate of about 500°C/s. to about 1000°C/s, and after reaching a first desired temperature, holding the temperature for a time period from about 1 ms to about 1000 s; and cooling the semiconductor material at a ramp-down rate from about 50°C/s to about 500 °C/s (col. 6, lines 45-67).

Since Lee (US '136) and Lee (US '640) are both from the same field of endeavor, the purpose disclosed by Lee (US '640) would have been recognized in the pertinent art of Lee (US '136) at the time the invention was made by one of ordinary skill in the art.

It would have been obvious to one having ordinary skill in the art, at the time the invention was made, to modify the invention of Lee (US '136) such that the first annealing process used to activate the source/drain extensions 26 comprises heating the semiconductor material from about 800°C to about 1200°C with a ramp-up rate of about 500°C/s. to about 1000°C/s, holding the temperature for a time period from about 1 ms

to about 1000 s, after reaching a first desired temperature, and cooling the semiconductor material at a ramp-down rate from about 50°C/s to about 500 °C/s, as taught by Lee (US '640), because under these annealing conditions the implanted first dopant ions are prevented from diffusing to a depth greater than the initial implantation depth, thereby resulting in the formation of ultra-shallow junctions [Lee (US '640) - col. 7, lines 45-50 and col. 8, lines 8-13].

Lee (US '136) does not teach that at least a part of the first and second annealing processes occur in one selected from the group consisting of: a vacuum, nitrogen gas, and inert gas, as recited in claim 9. However, Lee (US '640) teaches performing the annealing process in an inert gas (col. 7, lines 53-59). It would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the invention of Lee (US '136) by performing at least a part of the first and second annealing processes in an inert gas, as taught by Lee (US '640), since an inert gas will not react with the implanted dopant ions.

*Claim 11 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (US '136) in view Lee (US '640).*

Lee (US '136) does not teach implanting the second dopant ions to a concentration of about  $1 \times 10^{16}$  ions/cm<sup>3</sup> to about  $1 \times 10^{21}$  ions/cm<sup>3</sup>. However, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to implant the second dopant ions to a concentration of about  $1 \times 10^{16}$  ions/cm<sup>3</sup> to about  $1 \times 10^{21}$  ions/cm<sup>3</sup>, since it has been held that where the general conditions of a

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claim are disclosed in the prior art, discovering the optimum or working ranges involves only routine skill in the art (*In re Aller*, 105 USPQ 233).

***Allowable Subject Matter***

Claims 3, 4, 7, and 15 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

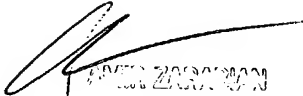
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Toniae M. Thomas whose telephone number is (571) 272-1846. The examiner can normally be reached on Monday through Thursday from 8:30 AM to 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

*TMJ*

December 23, 2003

  
AMIR ZARABIAN  
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Art Unit 2822  
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